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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/786,230	02/26/2004	Frank T. Hartley	ION-08	9191
26686	7590	02/03/2006	EXAMINER	
CARL A. KUKKONEN, III 525 Seabright Lane Solana Beach, CA 92075			KIM, TAE JUN	
			ART UNIT	PAPER NUMBER
			3746	

DATE MAILED: 02/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/786,230

Applicant(s)

HARTLEY, FRANK T.

Examiner

Ted Kim

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 15 December 2005.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-6 and 8-49 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 8-49 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02/26/2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION**

***Response to Amendment***

1. Applicant's response filed 12/15/2005 incorrectly lists the U.S. application serial number as 10/766,230 for sections including the amendments to the claims. The serial number is 10/786,230. Please use the correct serial number on all communications with the USPTO in order to ensure that the papers are properly matched to the correct application.
2. The claims filed 2/26/04 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure from the parent applications is as follows: the diversion of the ions and electrons (claims 5, 21, 44, 45). Applicant does not define in the specification any diversion/diverting occurring.
3. Applicant is required to cancel the new matter in the reply to this Office Action.

***Claim Rejections - 35 USC § 112***

4. Claims 1-6, 8-49 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The specification fails to disclose the essential components of a thruster including the gas source, the electrodes, the magnets, the controller, the source of the

small electric field, the magnetic field to linearly and rotationally accelerate the electron beam (page 9, lines 3+). Due to applicant's lack of disclosure, the claimed disclosure would not be enabled to one of ordinary skill in the art to make and use a thruster.

Applicant further discloses on page 10, lines 4-11 that Figure 7 shows an illustration of how the gas expands in a vacuum. This certainly does not show this and this paragraph is also not enabling to show what occurs in this system.

5. The specification does not clearly teach one of ordinary skill in the art to how to create the bipolar thruster (see page 9). The bipolar thruster requires the ions expelled from the front of the thruster and the electrons expelled from the rear of the thruster. It is unclear how this can be accomplished if there is gas flow in the direction 800 countering the flow. Moreover, it is unclear how the gas source would enter in such a situation.

6. Applicant further fails to show where the gas flow 800 comes from, does it come through the accelerator grid 830?

7. Applicant does not define in the specification what is covered by the "means + function language" of claim 49 and hence, it is not clear what is covered by applicant's usage of this language.

8. Claims 1-49 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement for the reasons set forth above. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claim 49 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant does not define in the specification what is covered by the “means + function language” of claim 49 and hence, it is not clear what is covered by applicant’s usage of this language.

### *Drawings*

11. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the small electric field and magnetic field to linearly and rotationally accelerate the electron beam, the use of additional ionization membranes and accelerator elements (e.g. claim 7), the control unit, the polarity of the electrodes being reversed, must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure

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is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency.

Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### *Specification*

12. The disclosure is objected to because of the following informalities: applicant's deletion of Fig. 7 requires specific amendment of the specification to reflect this.

Appropriate correction is required.

### *Claim Rejections - 35 USC § 102*

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

14. Claim 1, 10, 21-24, 44, 45, are rejected under 35 U.S.C. 102(b) as being anticipated by Webb (3,328,624). Webb teaches ion thrusting system, comprising: an ionization membrane 18 having at least one area through which a gas is passed, and which ionizes the gas molecules passing therethrough to form ions and electrons; and an accelerator element which accelerates the ions to form thrust (not shown but disclosed on col. 1, lines 17+). A tubular body is taught and claims 23, 24 are product by process limitations where the process is given little patentable weight in an apparatus claim.

15. Claims 1, 2, 10, 21-24, 26-28, 30-32, are rejected under 35 U.S.C. 102(b) as being anticipated by Martin (3,328,960). Martin teaches an ion thrusting system, comprising: an ionization membrane C2 (see col. 1, lines 37+) having at least one area through which a gas is passed, and which ionizes the gas molecules passing therethrough to form ions and electrons; and an accelerator element G3 which accelerates the ions to form thrust; the accelerator element G3 is a cathode; a second accelerator element G4 accelerates the ions to form thrust in a second direction. Since the nozzle N is converging-diverging it is inherently intended for supersonic speeds.

16. Claims 1-6, 10, 21-24, 26-30, are rejected under 35 U.S.C. 102(b) as being anticipated by Harries (3,117,416). Harries teaches an ion thrusting system, comprising: an ionization membrane 5, 6 comprising first and second electrodes having at least one porous area through which a gas is passed, and which ionizes the gas molecules passing therethrough to form ions and electrons; and an accelerator element 11 which accelerates the ions to form thrust; the accelerator element 11 is a cathode; a polarity of the

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electrodes 5, 6 may be reversed to enhance or inhibit/ reverse the flow (see particularly, col. 4, lines 4-25).

***Claim Rejections - 35 USC § 103***

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. Claims 8, 45-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harries (3,117,416) in view of either Hruby (6,075,321) or Egorov et al (5,218,271) and optionally Beattie et al (5,947,421). Harries teaches an ion thrusting system but does not specifically teach the ion thrusting system the electrodes being spaced less than a mean free path of the molecules to be ionized. Hruby teaches it is old and well known in the art to make the characteristic length L of the accelerator less than the mean free path (col. 1, lines 27+). Egorov et al teach a plasma/ion accelerator where making the length of the accelerator (which in the case of Harries is longer than the electrode spacing) less than the mean free path is a major condition for efficient operation (col. 1, lines 46+). It would have been obvious to one of ordinary skill in the art to employ space the electrodes less than the mean free path, in order to operate efficiently. As for the use of plural ionization devices, it is old and well known in the art to employ the ion thrusters in arrays and selectively operate them (see e.g. Figure 4) as taught by Beattie for e.g. attitude



adjustment in satellites. It would have been obvious to one of ordinary skill in the art to employ plural ionization devices and selectively operate them, in order to provide for attitude adjustment in satellites.

19. Claims 1, 2, 5, 6, 8-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adamo et al (6,577,130) in view of in view of either Hruby (6,075,321) or Egorov et al (5,218,271). Adamo et al teach an ion/plasma thrusting system (see col. 8, lines 55+), comprising: an ionization membrane 85 having at least one area through which a gas is passed (col. 8, lines 34), and which ionizes the gas molecules passing therethrough to form ions and electrons; a potential applied to said ionization membrane may be reversed to thrust ions in an opposite direction (col. 8, lines 41+). The membrane can be an insulating layer/dielectric 62 between a first metal electrode 48 and a second metal electrode 16' and employs either single emitters or multiple emitters/ionization holes. The membrane is so thin that it would appear to be a thickness less than the mean free path. Alternately, Hruby teaches it is old and well known in the art to make the characteristic length  $L$  of the accelerator less than the mean free path (col. 1, lines 27+). Egorov et al teach a plasma/ion accelerator where making the length of the accelerator (which in the case of Harries is longer than the electrode spacing) less than the mean free path is a major condition for efficient operation (col. 1, lines 46+). It would have been obvious to one of ordinary skill in the art to employ space the electrodes less than the mean free path, in order to operate efficiently. The Adamo et al patent does not specifically show the thruster details including an accelerator nor the tubular housing nor

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the gas delivery system, however, this is old and well known in the art as taught by Martin G3 which uses a tubular housing and a gas delivery system. It would have been obvious to one of ordinary skill in the art to employ an accelerator to enhance the efficiency and/or thrust output of Adamo et al. It would have been obvious to one of ordinary skill in the art to employ a tubular housing with a gas delivery system as a well known configuration used for thrusters. As for the material choices, these are old and well known in the art for their use in electrodes or dielectrics and would have been obvious to use as within the ordinary skill in the art. As for the claimed ranges, these are within the range of the Adamo et al patent and would have been obvious to use as an obvious matter of finding the workable ranges in the art. As for the claimed

20. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over any of the above prior art in view of Killinger et al (6,378,290). The above prior art teach various aspects of the claimed invention but do not teach the housing is quartz. Killinger et al teach making the thruster housing of quartz is well known in the art. It would have been obvious to one of ordinary skill in the art to employ quartz as a well known material used in the art.

### ***Response to Arguments***

21. Applicant's arguments filed 12/15/2005 have been fully considered but they are not persuasive. The amendments to the claims to direct them to an "apparatus for use with an" ion thrust system does not obviate the rejections under 35 USC 112, 1<sup>st</sup> paragraph. Even if the system is "for use" with an ion thrust system, sufficient detail of

the ion thrust system must be disclosed so one of ordinary skill in the art can ascertain how to make and use the invention. The bipolar thruster is further not fairly taught to one of ordinary skill in the art. Applicant argues

A bipolar thruster is described in paragraph 44 which recites "In this embodiment, a bipolar ion thruster may allow reversing the electrode potentials on the ionization membrane,

causing the electrons to pass through the membrane, while ions move behind the membrane. The high velocity ions are expelled from the front of the thruster, and electrons are expelled from the rear of the thruster. This engine can therefore be reversed in this way." This passage is more than sufficient for a skilled artisan to readily practice the claimed subject matter.

This is not convincing because the bipolar thruster requires the ions expelled from the front of the thruster and the electrons expelled from the rear of the thruster. It is unclear how this can be accomplished if there is gas flow in the direction 800 countering the flow. Moreover, it is unclear how the gas source would enter in such a situation.

Applicant argues

¶ The gas flow 800 may enter in through either the upper accelerator grid or the lower accelerator grid depending on which polarity the bipolar thruster is operating.

This is not persuasive as it is not disclosed nor previously illustrated. If the gas flows through the lower grid than this feature should have been illustrated and also disclosed and not "left to the imagination."

With regard to applicant's arguments concerning claims 5, 21, 44 and 45, it is not seen how applicants arguments bear any relationship with the meaning of "the diversion of the ions and electrons" (claims 5, 21, 44, 45). In order for something to be diverted it must have a reference direction from which it was originally coming and then the direction be changed. Applicant does not adequately define this conceptually.

22. Applicant argues limitations that do not appear in the claims, e.g. with regard to the Webb reference that ionization is thermally induced is irrelevant.

23. Applicant argues claims that were not rejected by that reference. For instance, Martin was not applied under 35 USC 102 for claim 44 and hence, applicant's argument is not persuasive.

24. Applicant's arguments with respect to Martin, Harries under 35 USC 102 fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

25. In response to applicant's argument that Harries in combination with either Hruby or Egorov et al and optionally Beattie et al is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Hruby and Egorov et al teach that the entire accelerator is less than the mean free path and note that

the accelerator is much longer than the electrode spacing. Hence, one of ordinary skill in the art would clearly be motivated to use the electrode spacing as less than the mean free path because this is required for efficient operation.

26. Applicant's arguments with regard to Adamo are not persuasive, arguing this device does not produce ions or plasma. Applicant's arguments are not persuasive as they ignore the cited portions of the specification (see col. 8, lines 55+) where it is clear that both ions and plasma are generated. Furthermore, applicant does not provide any rational why the device of Adamo et al regarded as not being a membrane. From the examiner's standpoint, the device of Adamo et al constitutes a membrane as it readily meets the following definition:

From Wikipedia, the free encyclopedia.

Jump to: [navigation](#), [search](#)



It has been suggested that *Net flux* be merged into this article or section. ([Discuss](#))

A membrane is a thin, typically planar structure or material that separates two environments. Because it sits between environments or phases and has a finite volume, it can be referred to as an interphase rather than an interface. Membranes selectively control mass transport between the phases or environments.

27. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

***Contact Information***

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Ted Kim whose telephone number is 571-272-4829. The Examiner can be reached on regular business hours before 5:00 pm, Monday to Thursday and every other Friday.

The fax numbers for the organization where this application is assigned are 571-273-8300 for Regular faxes and 571-273-8300 for After Final faxes.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Thorpe, can be reached at 571-272-4444.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist of Technology Center 3700, whose telephone number is 703-308-0861. General inquiries can also be directed to the Patents Assistance Center whose telephone number is 800-786-9199. Furthermore, a variety of online resources are available at <http://www.uspto.gov/main/patents.htm>



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Ted Kim	Telephone	571-272-4829
Primary Examiner	Fax (Regular)	571-273-8300
February 1, 2006	Fax (After Final)	571-273-8300
Technology Center 3700 Receptionist	Telephone	703-308-0861
Patents Assistance Center	Telephone	800-786-9199